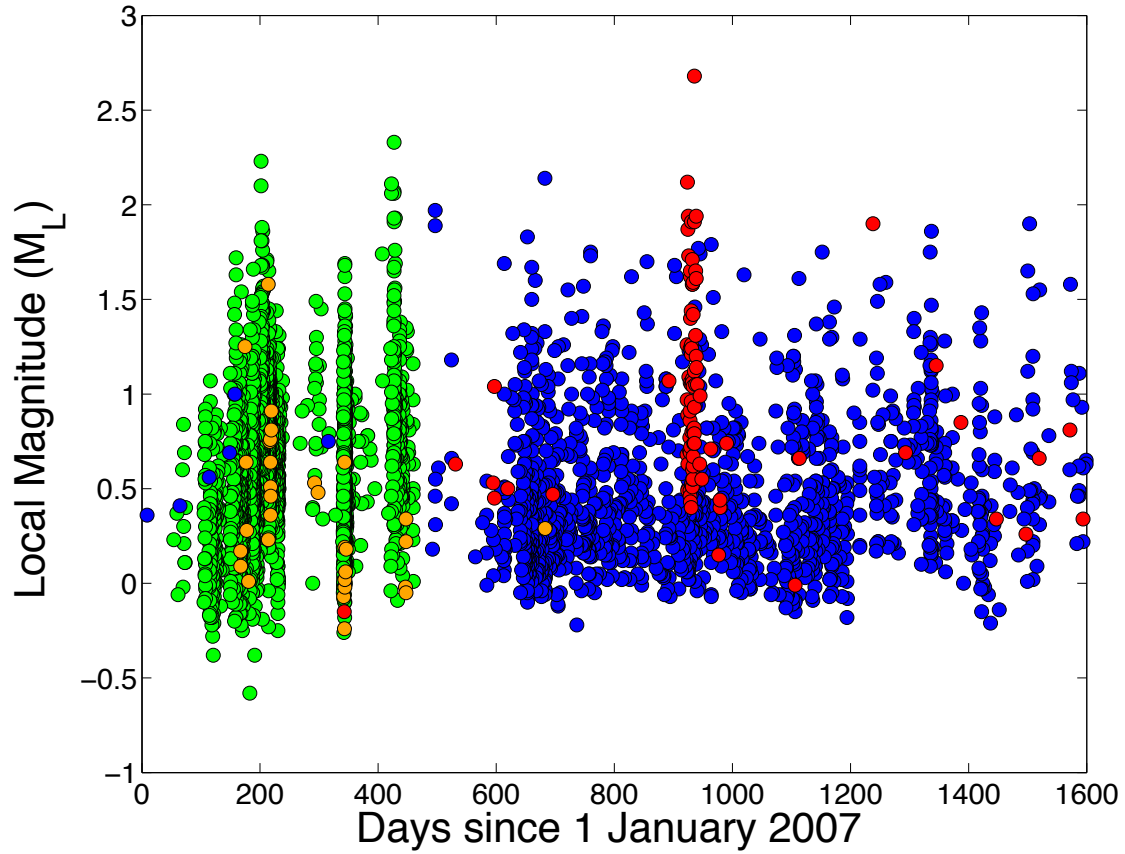


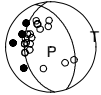
Supplementary Figure 1. Synthetic tests for accuracy of hypocentre depth recovery after location using HypoInverse-2000 (Klein 2002). The dotted line represents the depths output by HypoInverse-2000 versus the input synthetic depths when no distance weighting is applied to the arrivals. The dashed line represents the depths output by HypoInverse-2000 versus the input synthetic depths when distance weighting is applied to the arrivals. The HypoInverse-2000 distance weighting parameter, *DIS*, was set to 3 10 1 3. This means that all stations within a distance of 10 km from the synthetic epicentre (65.08°N, 16.27°W) are given full weight whereas stations further away than 30 km are given zero weight. A cosine taper is applied between these distances. The solid line depicts perfect correspondence between input synthetic depth and output Hypoinverse-2000 depth. This test was performed using the 2008–2009 network of Cambridge and IMO seismic stations.



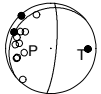
Supplementary Figure 2. Local magnitudes determined by the Icelandic Meteorological Office as a function of occurrence time for microseismic events in the reduced CMM catalogue (see main text for a description of the catalogue). Events and colour scheme are the same as for Fig. 4 in the main text. Green points represent deep events associated with the movement of melt within the dyke, orange points are events from cluster A overhead of the dyke, blue points are from cluster B at the brittle-ductile boundary, and red points are from cluster C at shallow depths.

(a) Cluster A

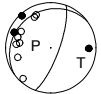
20070802 2144
Z= 1.83 M= 0.00



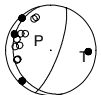
20070806 2135
Z= 3.47 M= 0.00



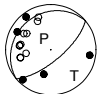
20070806 2137
Z= 3.31 M= 0.00



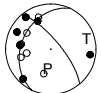
20070806 2142
Z= 3.49 M= 0.00



20070807 2358
Z= 2.78 M= 0.00

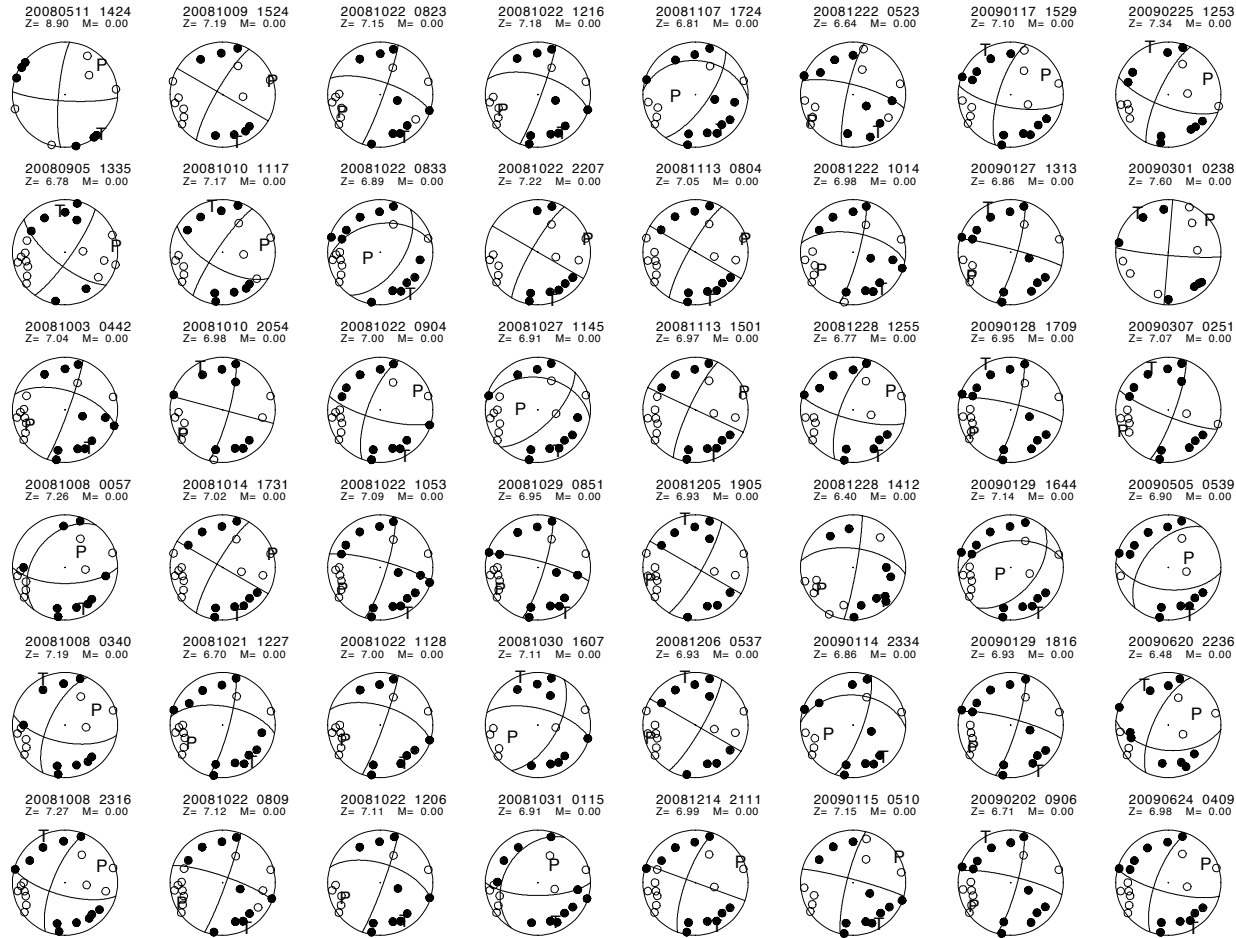


20070807 2359
Z= 2.69 M= 0.00

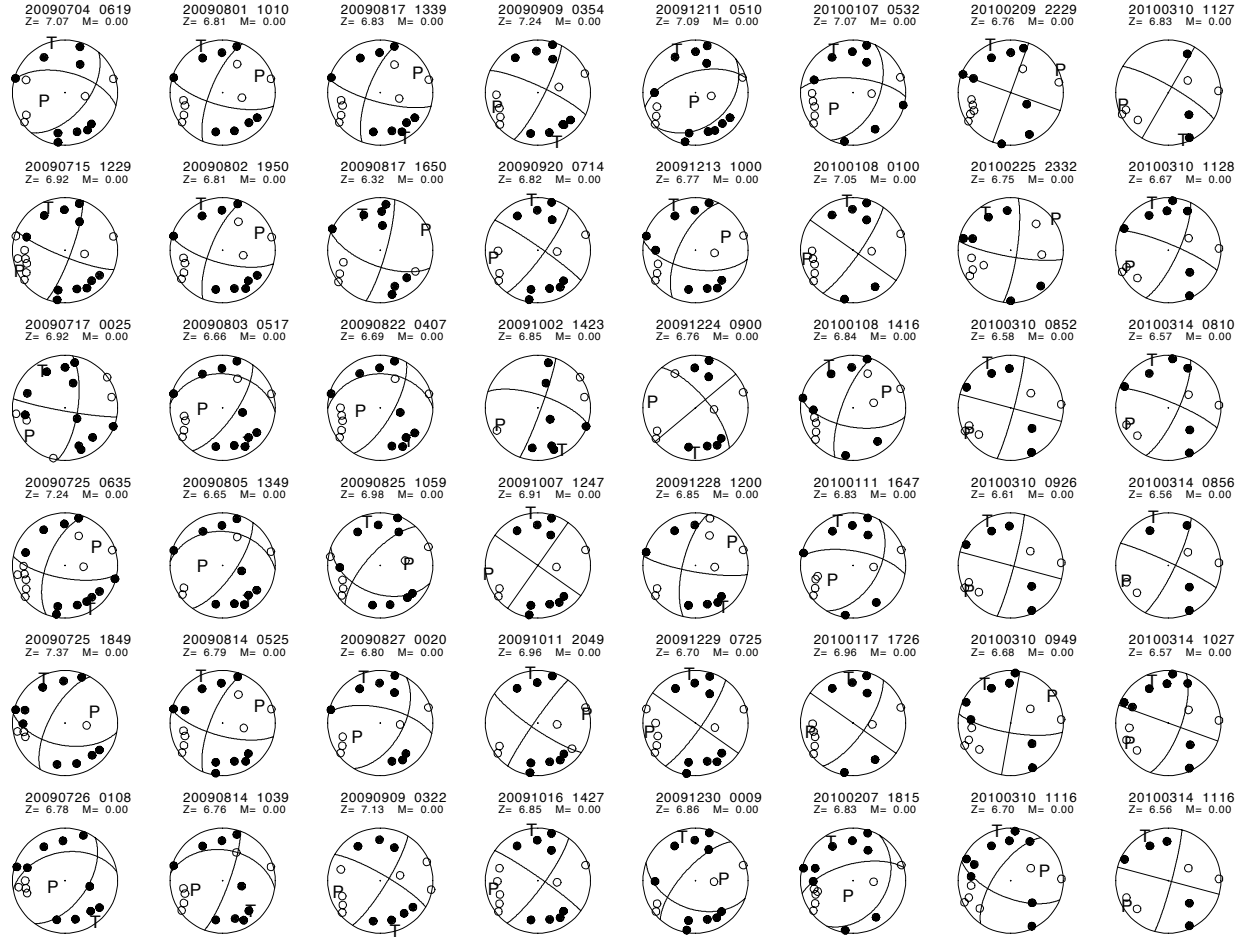


Supplementary Figure 3. Fault plane solutions output by *FPFIT* for all manually located events in (a) cluster A directly overhead of the dyke, (b) cluster B at the brittle-ductile boundary (see following pages), and (c) cluster C at depths near to the surface (see following pages). Events are labelled by date in YYYYMMDD HHMM format. Z corresponds to the depth of the event. M corresponds to the magnitude, which we have not included here; hence, this value is listed as zero.

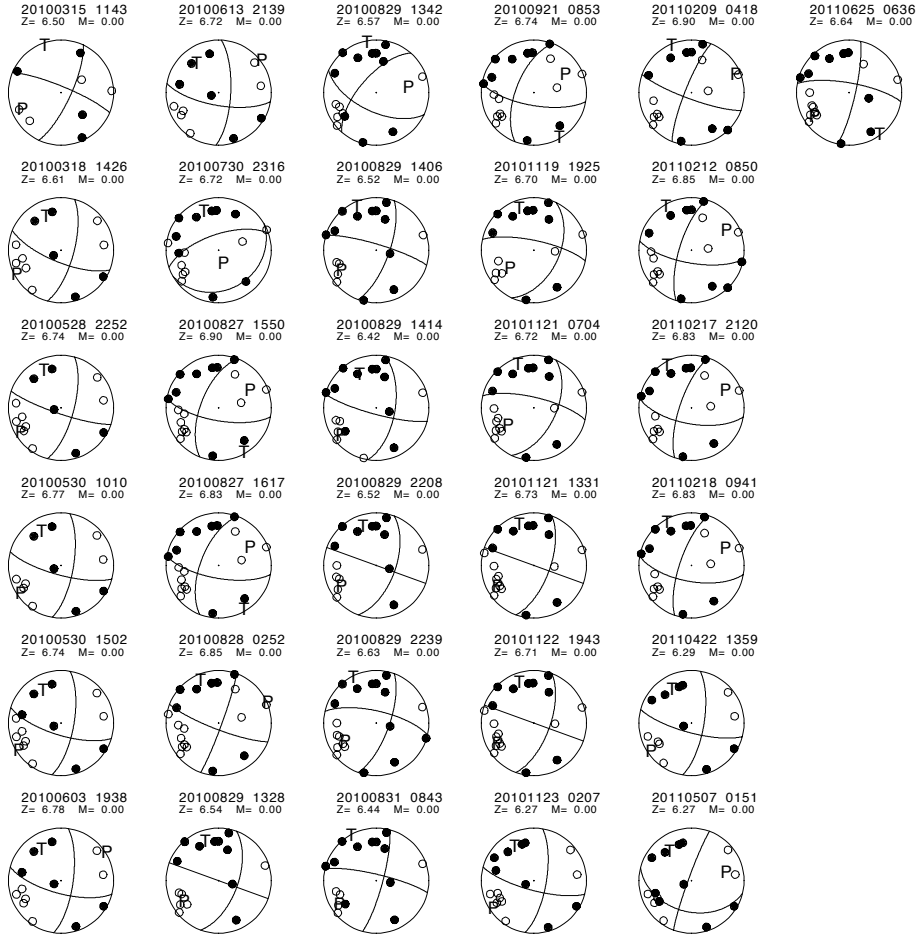
(b-1) Cluster B



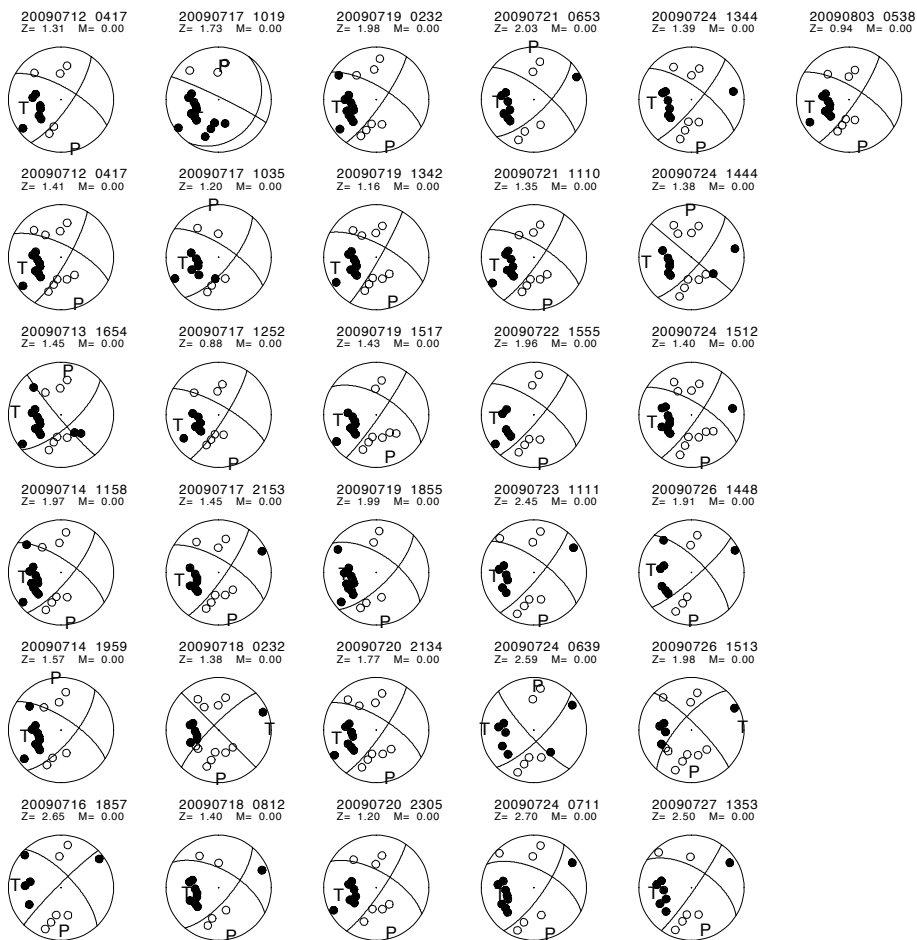
(b-2) Cluster B

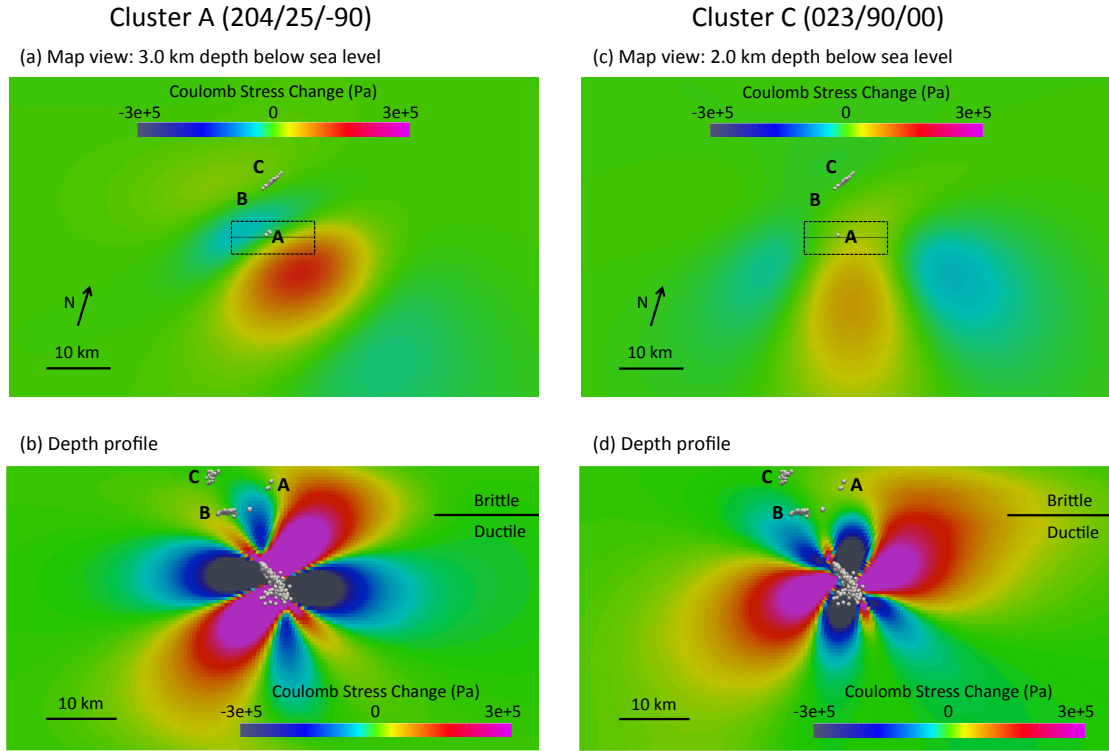


(b-3) Cluster B



(c) Cluster C





Supplementary Figure 4. Coulomb stress change patterns for a typical event in cluster A (left panels), but assuming slip on the alternative nodal plane (204/25/-90) to that considered in Fig. 10 from the main text, as well as Coulomb stress change patterns on strike-slip receiver faults aligned with the rift fabric (right panels), such as those of cluster B, but assuming left-lateral slip (023/90/000). Densities and seismic wave velocities adopted for our model are listed in Supp. Table 2; the effective coefficient of friction is 0.4. Panels (a) and (c): Map view at 3 km depth and 2 km depth, respectively. The grey line in the centre of the figure delineates the upward projection of the dyke at its central depth (16 km); the dashed black line outlines the vertical upward projection of the extent of the inclined dyke. Beige points depict earthquake hypocentres. Panels (b) and (d): Depth profiles cutting through the centre of the dyke along its dip direction and looking along strike. The deep hypocentres (13–19 km depth) delineate the dyke. The spatial scale bar applies to both horizontal and vertical directions.